## REMARKS

Claims 1, 2, 4-6, 8 and 31-52 are all the claims presently pending in the present Application. Claims 1, 5, 41 and 42 have been amended to more particularly define the claimed invention. Claims 47-52 have been added to claim additional features of the claimed invention.

It is noted that the amendments are made only to overcome the Examiner's non-statutory objections, and to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

Claims 1, 2, 4-6, 8, 31, 34, 37-42, 44 and 46 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lou, et al. (U.S. Patent No. 6,277,732 B1) in view of Allada et al. (U. S. Patent No. 6,218,317) and further in view of Chen, et al. (Effects of Slurry Formulations on Chemical-Mechanical Polishing of Low Dielectric Constant Polysiloxanes: Hydro-Organo Siloxane and Methyl Silsesquioxane, J.Vac. Sci. Technol. B 18(1) Jan/Feb 2000).

Claims 32 and 36 and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Lou, Allada and Chen, and further in view of the Applicant's Admitted Prior Art. Claim 33 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lou, Allada and Chen, and further in view of of Aoi (U.S. Patent No. 6,333,257 B1). Claim 35 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lou, Allada and Chen, and further in view of Yau, et al. (U.S. Patent No. 6,072,227).

Claim 43 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lou, Allada and Chen, and further in view of Lu, et al. (U.S. Patent No. 6,008,540). Claim 45 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Lou, Allada and Chen, and further in view ofand Wolf, et al. (Silicon Processing For The VLSI Era, Volume 1).

These rejections are respectfully traversed in view of the following discussion.

## I. THE CLAIMED INVENTION

The claimed invention (e.g., as recited, for example, in claim 1 and similarly recited in claims 5, 41 and 42) is directed to a semiconductor device having a multi-layered insulation film formed on a semiconductor substrate. The multi-layered insulation film includes a first insulation layer including an organic material having a dielectric constant which is lower than a silicon oxide dielectric constant, a second insulation layer including a polysiloxane compound having an Si-H group and formed on and adhering to a top of the first insulation layer, and a third insulation layer including an inorganic material and formed on and adhering to a top of the second insulation layer. The second insulation layer includes a hydride organosiloxane, and improves an adhesion property between the first insulation layer and the third insulation layer.

Importantly, the device further includes a plurality of wires which are formed in grooves formed in the multi-layered insulation film, the multi-layered insulation film filling a space between the wires (Application at Figure 1; page 23, lines 10-15).

Conventional devices may include an insulation layer formed between wires. However, many such conventional devices have difficulty with one layer in the insulation layer peeling away from the other (Application at page 2, lines 12-27; Figure 5).

The claimed invention, on the other hand, includes a plurality of wires which are formed in grooves formed in a multi-layered insulation film (e.g., including a second layer which improves an adhesion property between the first insulation layer and the third insulation layer), the multi-layered insulation film **filling a space between the wires**. This helps the claimed invention to inhibit a crosstalk between wires formed in the grooves of the multi-layered insulation film and helps to inhibit a peeling-off of the third insulation layer), (Application at Figure 1; page 23, lines 10-15).

## II. THE ALLEGED PRIOR ART REJECTIONS

### A. Lou, Allada and Chen

The Examiner alleges that Lou would have been combined with Allada and that the alleged Lou/Allada combination would have been further combined with Chen to form the

invention of claims 1, 2, 4-6, 8, 31, 34, 37-42, 44 and 46. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

In particular, Applicant would point out that Lou is intended to address the problem of low thermal conductivities which are often realized when using a low dielectric constant material, by using layered insulation films which have low dielectric constant and high thermal conductivity.

In complete contrast to Lou, Allada is intended to address the problems involved with forming an undoped silicon glass (USG) hardmask on a polymer-insulated material without taking out a wafer from a spin-truck device, by producing multilayered wires in which both the hardmask and a layered insulation material are capable of being spin-coated.

Moreover, in complete contrast to Lou and Allada, Chen is intended to provide a method for chemically and mechanically controlling the chemical mechanical polishing (CMP) characteristics of polysiloxanes which have low dielectric constants.

Thus, clearly Lou, Allada and Chen have completely different problems and objects to be solved. Thus, since the problems and objects to be solved differ between Lou and Allada, there clearly is no motivation to combine Lou and Allada as alleged by the Examiner. Further since the problems and objects to be solved differ between Allada and Chen, there exists no motivation to combine Allada (e.g., or the alleged Lou/Allada combination) with Chen.

In short, Applicant respectfully submits that these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

In fact, Applicant submits that the references provide no motivation or suggestion to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither Lou, nor Allada, nor Chen, nor any alleged combination thereof teaches or suggests "*a plurality of wires which are formed in grooves formed in said multi-*

*layered insulation film, said multi-layered insulation film* ***filling a space between said wires***", as recited, for example, in claim 1 and similarly recited in claims 5, 41 and 42.

As noted above, unlike conventional devices, the claimed invention includes a plurality of wires which are formed in grooves formed in a multi-layered insulation film (e.g., **including a second layer** which improves an adhesion property between the first insulation layer and the third insulation layer), **the multi-layered insulation film filling a space between the wires**. The multi-layered insulation film of the claimed invention helps to inhibit a crosstalk between wires formed in the grooves of the multi-layered insulation film and helps to inhibit a peeling-off of the third insulation layer (Application at Figure 1; page 23, lines 10-15).

Clearly, the cited references do not teach or suggest these novel features. Indeed, the Examiner basically concedes that Lou does not teach or suggest this feature (Office Action at page 3). However, the Examiner states that "a plurality of grooves" is "seen to be inherent because the interconnection structure of Fig. 1E would have multiple vias as the interconnection structure is continuously showing".

However, Applicant would respectfully submit that a plurality of vias in an interlayer insulation film is not "inherent", as asserted by the Examiner. Moreover, even assuming (arguendo) that a plurality of vias is inherent, Lou still does not teach or suggest this feature of the invention.

In particular, the Examiner attempts to equate the layers 208, 210 and 212 with the multi-layered insulation film of the claimed invention. However, Lou teaches wires 202a, 202b and 202c, which are separated by spaces which are filled primarily with layers 206 and 208 (layer 210 is formed in only some of the spaces (Lou at Figure 1E). That is, **nowhere is layer 212 which the Examiner alleges is part of the "multi-layer insulation film", formed in the spaces between the wires 202a, 202b and 202c.** Therefore, even assuming (arguendo) that layers 208, 210 and 212 may form a "multi-layered insulation film", the film (i.e., layers 208, 210 and 212) clearly does not fill the space between the wires 202a, 202b and 202c.

In fact, even assuming (arguendo) that the metal plug 218 in the Lou device is equivalent to the wires in the claimed invention, and assuming (arguendo) that it would be obvious to include a plurality of such plugs 218 in the Lou device, the layers 208, 210 and 212 in such an

imaginary structure would not fill a space formed between the plugs 218. Indeed, as illustrated in Figure 1E in such an imaginary structure, the silicon oxide liner layer 206 would be formed in the space between the plugs 218. Thus, the layers 208, 210 and 212 would not "fill the space" between the plugs 218 in such an imaginary structure.

Applicant would point out that silicon oxide layer 206 likely does not have the same effect of helping to inhibit a crosstalk between wires, as a layer, for example, including an organic material having a dielectric constant which is lower than silicon oxide. Therefore, unlike the claimed invention in which the multilayer insulation film <u>fills a space between the wires</u>, the Lou device would likely experience a problem with crosstalk.

Similarly, Allada does not teach or suggest these novel features of the claimed invention. Indeed, the Examiner merely attempts to rely on Allada as allegedly teaching an insulating film including a methylated hydrido organo siloxane polymer (HOSP).

Specifically, the Examiner attempts to rely on col. 2, lines 7-67 in Allada to support his position. However, nowhere in this passage, or anywhere else for that matter, does Allada teach or suggest a <u>multi-layered insulation film filling a space between wires which are formed in grooves in the multi-layered insulation film</u>. Indeed, this passage merely teaches a layer including HOSP that is used as a mask 28 and is formed between two polymer layers 24, 26 (Allada at col. 3, lines 7-25; Figure 2b). That is, nowhere does Allada even teach or suggest the multi-layered insulation film of the claimed invention or a plurality of grooves, let alone that the multi-layered insulation film fills a space betweeen wires formed in grooves in the multi-layered insulation film. Thus, Allada clearly does not make up for the deficiencies of Lou.

Likewise, Chen does not teach or suggest these novel features. Indeed, the Examiner again attempts to rely on Chen as teaching methylated hydrido organo siloxane polymer (HOSP). The Examiner attempts to rely on Figure 1 in Chen to support his position.

However, nowhere in Figure 1, or anywhere else for that matter, does Chen even teach or suggest the multi-layered insulation film of the claimed invention or a plurality of grooves, let alone that the multi-layered insulation film <u>fills a space betweeen wires</u> formed in grooves in the multi-layered insulation film. Thus, Chen clearly does not make up for the deficiencies of the alleged Lou/Allada combination.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

**B. The Alleged Admitted Prior Art (AAPA), Aoi, Yau, Lu and Wolf**

The Examiner alleges that Lou would have been combined with Allada and that the alleged Lou/Allada/Chen combination would have been further combined with the AAPA to form the invention of claims 32 and 36, with Aoi to form the invention of claim 33, with Yau to form the invention of claim 35, with Lu to form the invention of claim 43, and with Wolf to form the invention of claim 45. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

Indeed, Applicant submits that these references are completely <u>unrelated</u>, and no person of ordinary skill in the art would have considered combining these disparate references, <u>absent impermissible hindsight</u>.

In fact, Applicant submits that <u>the references provide no motivation or suggestion</u> to urge the combination as alleged by the Examiner. Indeed, these references clearly do not teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has <u>failed to make a prima facie case of obviousness</u>.

Moreover, neither Lou, Allada, Chen, the AAPA, Aoi, Yau, Lu, nor Wolf, nor any alleged combination thereof teaches or suggests "*a plurality of wires which are formed in grooves formed in said multi-layered insulation film, said multi-layered insulation film filling a space between said wires*", as recited, for example, in claim 1 and similarly recited in claims 5, 41 and 42.

As noted above, in the claimed invention **the multi-layered insulation film (e.g., including the second layer) <u>fills a space between the wires</u>**. The multi-layer insulation film helps to inhibit a crosstalk between wires formed in the grooves of the multi-layer insulation film

and helps to inhibit a peeling-off of the third insulation layer (Application at page 23, lines 10-15).

Clearly, these features are not taught or suggested by either the AAPA, Aoi, Yau, Lu or Wolf. Indeed, Applicant points out that the Examiner is not attempting to rely on any of these references as allegedly teaching these features. Instead, the Examiner is attempting to rely on these references as allegedly teaching other features of the claimed invention.

Specifically, the Examiner attempts to rely on page 2, lines 5-8 and page 5, lines 9-24 of the Application (e.g., the AAPA) to support his position. However, the AAPA merely teaches a layer including layer 2 including an organic material and layer 4 including an inorganic material. Thus, nowhere does the AAPA teach or suggest the multi-layered insulation film (e.g., including a second insulation layer including a polysiloxane compound having an Si-H group and formed on and adhering to a top of the first insulation layer) of the claimed invention.

The Examiner also attempts to rely on Figures 4a-11 and col. 10, lines 1-11 in Aoi to support his position. However, this passage merely teaches an organic film 204 including a polyimide fluoride film or polyaryl ether film.

The Examiner attempts to rely on Figures 8H and 10H and columns 13 and 14 in Yau to support his position. However, the Examiner attempts to equate layers 710, 714, 716, 718 and 722 with the multi-layer insulation film of the claimed invention. This is clearly unreasonable.

Indeed, for example, layer 716 which the Examiner attempts to equate with the second insulation layer in the claimed invention, is an etch stop layer formed of silicon oxide or silicon nitride (Yau at col. 14, lines 15-20). Thus, it is clearly unreasonable to attempt to equate this etch stop layer 716 with part of the second insulation layer of the claimed invention.

Thus, since the etch stop layer 716 is formed between the connect lines 724, Yau cannot teach or suggest a multi-layered insulation film (e.g., as in the claimed invention) which <u>fills a space between wires</u> in the multi-layered insulation film. In fact, the dual damascene structure in Yau is completely unrelated to the claimed invention.

The Examiner attempts to rely on Figures 2b and 3f and columns 1 and 3 in Lu to support his position. However, Lu is merely directed to a surface treatment for porous silica and is completely unrelated to the claimed invention. Specifically, Lu teaches to form a gap fill layer

520 on a xerogel 510 (Lu at Figure 5).

Specifically, the Examiner suprisingly attempts to equate the adhesion layer 344 in Lu with the second insulation layer in the claimed invention (e.g., see Lu at Figure 3f; col. 6, lines 49-62). This is clearly unreasonable.

In fact, unlike the second insulation layer in the exemplary aspects of the claimed invention, the layer 344 does not include a hydride organosiloxane, and does not improve an adhesion property between a first insulation layer (e.g., including an organic material) and said third insulation layer (e.g., including an inorganic material). Instead, the layer 344 is merely intended to adhere the oxide layer 346 **to the the silica xerogel 342 which is not an organic layer.** That is, unlike the claimed invention which may be used to adhere an organic layer to an inorganic layer, Lu merely forms the layer 344 between two inorganic layers and is completely oblivious to the features of the claimed invention.

The Examiner also attempts to rely on pages 168-174 in Wolf to support his position. However, Wolf merely discloses variour processing equipment and does not teach or suggest a multi-layered insulation film, let alone the device including a multi-layered insulation film of the claimed invention.

In particular, nowhere does Wolf teach or suggest <u>a plurality of wires which are formed in grooves formed in a multi-layered insulation film</u>. Moreover, Wolf certainly does not teach or suggest that <u>the multi-layered insulation film fills a space between the wires</u>. Thus, Wolf clearly does not make up for the deficiencies of the other cited references.

Therefore, Applicant respectfully submits that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

## III. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1, 2, 4-6, 8 and 31-52, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above

application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully submitted,

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**CERTIFICATE OF FACSIMILE TRANSMISSION**

I hereby certify that the foregoing was filed by facsimile with the United States Patent and Trademark Office, Examiner Julio Maldonado, Group Art Unit #2823 at fax number (703) 872-9306 this 26th day of April, 2005.

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